Monitoring global changes and water management strategies in Mediterranean mountain environments: hydro-socio-eco-meteorological observations in the Cévennes Mountains (Southeast France).

V. Wendling [1]*, *P-A. Ayral* [2], *J. Cerceau* [1], *J. Arnaud* [3], *G. Artigue* [1], *B. Boudevillain* [4], G. Demarty [5], *N. Chahinian* [5], *C. Guilhe-Batiot* [5] , *J. Le Coz* [6], *G. Nord* [4], *C. Ollivier* [5], *I. Ruin* [4], *A. Johannet* [1], *D. Josselin* [2]

* valentin.wendling@imt-ales.fr

[1] HSM, Univ Montpellier, CNRS, IRD, IMT Mines Alès, Alès, France
[2] ESPACE, CNRS, Saint-Christol-lès-Alès, France
[3] Comité Départemental de Spéléologie de l'Ardèche, Chauzon, France
[4] IGE, Univ. Grenoble Alpes, INRAE, CNRS, IRD, Grenoble INP, Grenoble, France
[5] HSM, Univ Montpellier, CNRS, IRD, IMT Mines Alès, Montpellier, France
[6] RIVERLY, INRAE, Lyon, France

Mont Lozère

Hydrology in Mediterranean Mountainous experimental catchments

Five experimental catchments (0.2 to 12km²) located on granitic substratum have been monitored since **1981**. Ranging from 900 to 1 500 m of altitude, these catchments have different land covers: **grassland, resinous, deciduous and mixied forests**.

Parameters:
Atmosphere : rain, insolation, relative humidity, temperature, wind speed and direction
River flow : level, discharge, water temperature, geochemistry

Galeizon

Flash flood, low flow

Galeizon is a **meso-scale catchment** (85 km²) mostly forested with some farmland and villages. There is no large hydraulic installations in the watershed and **its flow is natural** ("**wild river site**" label).

Parameters:
Atmosphere : rain
River flow : level, discharge, temperature, sedimentary fluxes (in 2023)

Olivier de Serres

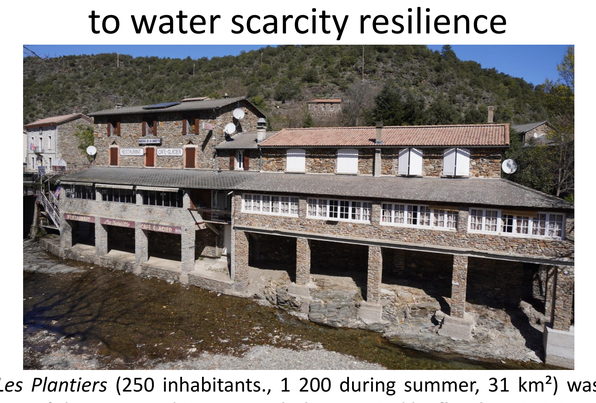
Hydrology in Mediterranean farmland hills : Flash floods, hydrometeorology, water pathways, erosion and river fluxes

Olivier de Serres corresponds to **three nested catchments** : Gazel (3 km²), Claduègne (43 km²) and Auzon (116 km²). It is an **agricultural area** with pastures, vineyards and Mediterranean Garrigue. The catchments' upstream are located on a basaltic plateau (900m), their downstream parts on sedimentary rocks (limestones and marls). Sites are monitored since **2011**, with a high-resolution hydro-meteorological sampling in 2012-2016.

Parameters:
Atmosphere: air temperature and humidity, wind speed and direction, solar radiation, surface temperature, air pressure, precipitation, drop size
Soil : water content, temperature
River flow : level, discharge, surface velocity (radar & large-scale particle image velocimetry), turbidity, temperature, conductivity, sediments (sampling during floods)

Les Plantiers

A living Lab dedicated to water scarcity resilience



Les Plantiers (250 inhabitants., 1 200 during summer, 31 km²) was one of the municipalities particularly impacted by **floods** in 2020 and the severe **drought** in 2022 in the Cévennes area. Created in June **2023**, the Living Lab's main objective is to **cross local and scientific knowledge** for helping inhabitants to use, save and manage the water in the context of resource scarcity.

Planned observations:
Socio-hydrology: survey, participative cartography, participative hydro-meteorological measurements, hydro-social trajectories, identification of local hydrological knowledge
Atmosphere : rain
River flow : level, discharge

Partners : citizens and officials

Valescure

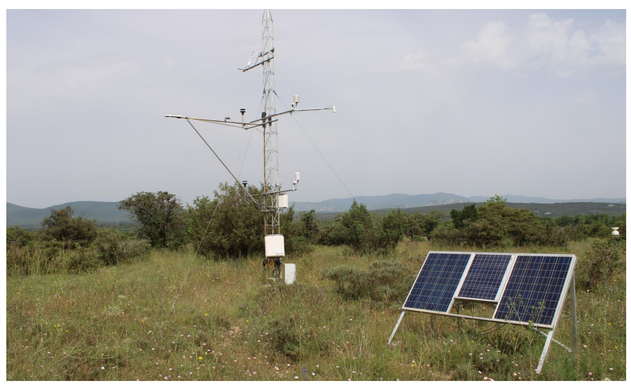
Flash flood, low flow, water pathways, and hydro-sedimentary fluxes

This site is representative of the Cévennes area, ranging between 230 and 815 m with a granite bedrock. **Forest** covers 98% of this site. Many "ancient hydraulic installations" are present: terraces, cross bars and tancats (dry stone works barring the talwegs – See photo). **Four nested catchment** are monitored **since 2003** : Valescure aval (4 km²), Abrits (0.6 km²), - Cartaou (0.8 km²) and Bastide (0.4 km²). Since 2017 the Rieu catchment (4km²) has been monitored, it is a similar catchment but on a schist bedrock.

Parameters:
Atmosphere: rain, insolation, relative humidity, temperature, wind speed
Soil: water content
River flow: level, discharge, temperature, sedimentary fluxes since 2022

Ceyrac

Evapotranspiration in Mediterranean scrubland



The Ceyrac site was instrumented to improve our knowledge of the **adaptation of native plants** (juniper, thistle, boxwood…) to the **Mediterranean climate** in **2019**. The various components of the water and energy cycles are monitored with a high time resolution. This site is located close to an intermittent river.

Parameters:
Atmosphere: temperature, humidity, pressure, wind speed and direction, solar and thermal radiation, photosynthesis radiation, surface temperature, precipitation, gases concentrations (H2O, CO2)
Soil: temperature, moisture, heat flux
River flow: level, discharge

Basalts, rhyolites
Granites
Gneiss
Shales and sandstones
Sandstone
Limestone, marl
Chalk
Clay
Sands

Cévennes mountains
Alès
Avignon
Nîmes
Montpellier
0 10 20 km
N W E S

Under climate and global change, the Cévennes socio-ecosystems suffer from water scarcity and sometimes poor water quality. We are setting up socio-eco-hydrological observatories to monitor the adaptative evolution to these issues. This set up began 15 years ago with the study of flash floods risk and matter transport risk awareness and human behaviours during and between hydroclimatic crise. The ongoing socio-eco-hydrological monitoring is co-constructed with citizens and local policymakers in order to use science to advise decision making toward durability and resilience.
Cévennes sites are part of the upcoming eLTER platform P3M : Mediterranean Plain, Piedmont and Plateau.

In addition to long-term monitoring, this sites are privileged supports to test new measurement techniques and build interdisciplinary and participatory research projects. We welcome collaborations and provide a local expertise to projects requiring sites in Mediterranean mountains.

Data are free access on observatories website:

OHM-CV: https://ohmcv.osug.fr/

SNO KARST : https://sokarst.org/sites/medycyss/